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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/687,186	10/16/2003	Sergey D. Lopatin	039153-0484 (G1190)	7567
26371	7590	09/29/2005	EXAMINER	
FOLEY & LARDNER 777 EAST WISCONSIN AVENUE SUITE 3800 MILWAUKEE, WI 53202-5308			NGUYEN, THANH T	
			ART UNIT	PAPER NUMBER
			2813	

DATE MAILED: 09/29/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

AK

<b>Office Action Summary</b>	<b>Application No.</b> 10/687,186	<b>Applicant(s)</b> LOPATIN ET AL.	
	<b>Examiner</b> Thanh T. Nguyen	<b>Art Unit</b> 2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 18 July 2005.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Response to Arguments*

Applicant's arguments with respect to claims 1-20 have been considered but are moot in view of the new ground(s) of rejection.

### *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 5, 8-10, 12-13, 15-17, 19-20 are rejected under 35 U.S.C. 102(e) as being anticipated by Park et al. (U.S. Patent No. 2005/0124154).

Referring to figures 1-3, Park et al. teaches a method of using an adhesion precursor in an integrated circuit fabrication process, the method comprising:

Providing a first gas over a dielectric material (210) to form an adhesion precursor layer (230, see paragraphs# 22-23 depositing the layer by using CVD ones has to use gas

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for deposition), the dielectric material including an aperture (120), the first gas including a ternary element of Iridium, Ruthenium, or Rhenium (see paragraphs# 22-23);

Providing a second gas including over the adhesion precursor layer (240) includes tin, indium, zinc, or chromium (see paragraph# 25); and

provide a copper layer (370) over the adhesion precursor layer (see paragraph# 28).

Regarding to claim 9, an alloy layer (240) above the adhesion layer (230, see paragraph# 25)

Regarding to claim 12, the bending layer includes an alloying material (240, see paragraph# 25).

Regarding to claim 13, adhesion precursor layer comprise a barrier layer that includes a tantalum nitride, tungsten nitride or disilicon nitride (see paragraph# 22)

Regarding to claim 15, forming a continuous barrier adhesion precursor layer above the dielectric layer and along sides of the trench (230, see figure 2a)

Regarding to claim 17, providing a chemical mechanical polish to level the copper to substantially the same level as the continuous barrier layer above the dielectric layer (see paragraph# 31).

Claims 7-20 are rejected under 35 U.S.C. 102(e) as being anticipated by Omstead (U.S. Patent No. 6,713,373).

Referring to figures 2-11, Omstead teaches a method of using an adhesion precursor in an integrated circuit fabrication process, the method comprising:

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Providing a first gas over a dielectric material (304) to form an adhesion precursor layer (404, depositing the layer by using CVD ones has to use gas for deposition), the dielectric material including an aperture (308), the first gas including a ternary element of Iridium, Ruthenium, or Rhenium (see col. 3, lines 50-58); and

Providing a second gas including an alloying agent over the adhesion precursor layer to provide a copper layer (604/704) over the adhesion precursor layer (see col. 4, lines 37+, noted CVD process ones has to use gas for deposition).

Regarding to claim 7, first gas material is layer (404, RuO<sub>2</sub>), second layer of material is (RuO<sub>x</sub>, see col. 4, lines 15-36), the third gas including an alloy element (see col. 3, lines 38-40, col. 4, lines 15-36), and forming a copper layer (704).

Regarding to claim 18, the adhesion precursor layer has a thickness of 10-100 Angstroms (see col. 6, lines 1-6)

Regarding to claim 8, providing a second gas of a second material over the adhesion precursor layer (Ruthenium, 504 by CVD)

Regarding to claim 13, adhesion precursor layer comprise a barrier layer that includes a tantalum nitride, tungsten nitride or disilicon nitride (see col. 6, lines 15-48)

Regarding to claim 14, the alloy layer has a thickness of up to 50 Angstroms (Ruthenium of the bilayer 504, see col. 6, lines 1-6).

Regarding to claim 15, forming a continuous barrier adhesion precursor layer above the dielectric layer and along sides of the trench (404, see figure 4)

Regarding to claim 17, providing a chemical mechanical polish to level the copper to substantially the same level as the continuous barrier layer above the dielectric layer (see col. 5, lines 26-30).

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 1-4, 6, 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Park et al. (U.S. Patent No. 2005/0124154) as applied to claims 5-6, 8-10, 12-13, 15-17, 19-20 above or Omstead (U.S. Patent No. 6,713,373) as applied to claims 7-13, 15-20 above in view of Li (U.S. Patent No.2004/0192021).

Referring to figures 2-11, Omstead teaches a method of using an adhesion precursor in an integrated circuit fabrication process, the method comprising:

Providing a first gas over a dielectric material (304) to form an adhesion precursor layer (404, depositing the layer by using CVD ones has to use gas for deposition), the dielectric material including an aperture (308), the first gas including a ternary element of Iridium, Ruthenium, or Rhenium (see col. 3, lines 50-58); and

Providing a second gas including an alloying agent over the adhesion precursor layer to provide a copper layer (604/704) over the adhesion precursor layer (see col. 4, lines 37+, noted CVD process ones has to use gas for deposition).

And also Park et al. teaches a method of using an adhesion precursor in an integrated circuit fabrication process, the method comprising:

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Providing a first gas over a dielectric material (210) to form an adhesion precursor layer (230, see paragraphs# 22-23 depositing the layer by using CVD ones has to use gas for deposition), the dielectric material including an aperture (120), the first gas including a ternary element of Iridium, Ruthenium, or Rhenium (see paragraphs# 22-23);

Providing a second gas including over the adhesion precursor layer (240) includes tin, indium, zinc, or chromium (see paragraph# 25); and

provide a copper layer (370) over the adhesion precursor layer.

However, the reference does not teach forming a copper layer film by providing a gas including an alloying agent.

Li teaches forming a copper alloy layer by using atomic layer chemical vapor deposition to deposit on the barrier/adhesion layer (see paragraph# 9, 79, noted that CVD or PEALD are deposition using gas).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would form a layer copper alloy form the alloy agent in process of Omstead or Park et al. as taught by Li because the copper alloy layer would increase the hardness of copper film and also reduce electromigration.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh Nguyen whose telephone number is (571) 272-1695, or by Email via address Thanh.Nguyen@uspto.gov. The examiner can normally be reached on Monday-Thursday from 6:00AM to 3:30PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, can be reached on (571) 272-1702. The fax phone number for this Group is (571) 273-8300.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956 (See MPEP 203.08).

A handwritten signature in black ink, appearing to read 'Thanh', with a long horizontal stroke extending to the left.

Thanh Nguyen  
Patent Examiner  
Patent Examining Group 2800

TTN